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Witch Flounder in NAFO Divisions 2J3KL

by

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## ABSTRACT

Nominal catches have been less than 8,000 t annually since 1977 with catches since 1979 ranging between 3-4,000 t. The oldest age in this stock according to research vessel survey information has been reduced from 26 years in 1976 to 15 years in 1983 with the major portion of the 1983 stock in the 6-13-year-old range. Weights at age for the major commercial age groups (8-13) have shown a substantial increase from 1978 to 1983 according to research vessel data collected in Division 3K. The stock appears stable with minimum trawlable biomass estimates for Div. 2J3KL near 40,000 t. Long-term fishing mortality has been near  $F_{0,1} = 0.35$  corresponding to average annual removals near the present TAC of 8,000 t.

#### RESUME

Les prises nominales, depuis 1977, sont inférieures à 8 000 t annuellement, celles de 1979 étant situées entre 3 et 4 000 t. D'après les observations recueillies par navires de recherche, l'âge maximal de ce stock est passé de 26 ans en 1976 à 15 ans en 1983, la majeure portion du stock étant comprise entre 6 et 13 ans. Toujours selon les données recueillies par navires de recherche dans la div. 3K, il y eut substantielle augmentation des poids par âge des principaux groupes d'âge commerciaux (8-13 ans) de 1978 à 1983. Le stock semble stable, la biomasse chalutable minimale estimée dans les div. 2J 3KL étant de près de 40 000 t. La mortalité par pêche à long terme est voisine de  $F_{0,1} = 0,35,ce$  qui correspond à une récolte annuelle se rapprochant de l'áctuel TPA de 8 000 t.

# CATCHES

Nominal catches of witch flounder in NAFO Divisions 2J3KL declined steadily from a level of 24,000 t in 1973 to 3,000 t annually in 1982 and 1983 (Fig. 1). This is probably a reflection of reduced stock abundance (particularly in older age groups) and reduced fishing effort towards the species especially since 1977 with the introduction of a 200 mile economic zone. The fishery is essentially a by-catch fishery therefore CPUE statistics are difficult to interpret. The fishery is mainly prosecuted in Div. 3K where most of the abundance occurs followed by Div. 3L. Very little fishing occurs in Div. 2J since witch flounder reaches its northern limits in the southern portion of this division.

Although for management purposes Div. 2J, 3K, and 3L are combined, it has been shown through several stock identification studies that at least three separate breeding stocks exist in this management area.

#### AGE COMPOSITION-COMMERCIAL

Estimates of age composition from the commercial fishery were available since 1976. For most years the data are very minimal, particularly the intermediate years, and are not all considered representative enough of the commercial catch for detailed assessment purposes. The 1983 data, however are based upon good sampling of the commercial catch. A list of samples used to break down the 1983 commercial catch by age is presented in Table 1.

The major change in age composition since 1976 is the reduction in the number of age groups available to the fishery indicating very high mortality on the age groups particularly beyond age 12 years (Fig. 2). In 1976 more than half the catch was age 12 and older whereas in 1983 age 12 and older comprised less than 10% of the catch.

## AGE COMPOSITON - RESEARCH

Since the major portion of the stock occurs in NAFO Div. 3K, the age compositions from the fall surveys from 1978-83 are compared from this division. Although there has been a reduction in the number of age groups since 1978 (Fig. 3), the age composition appears to have remained relatively stable over the last several years with a predominance of 7-10 year-olds. The age composition from research vessel surveys in Division 3K is very similar to that estimated for the commercial removals at age.

Mean numbers per standard tow with 95% confidence limits were plotted from surveys in Division 3K from 1978-83 inclusive (Fig. 4). Numbers were plotted for all ages combined and for ages 4, 5, and 6 separately. Only strata common to all surveys were used in the calculations. Mean numbers per tow were on a decline from 1978 to 1981, stabilized in 1981 and 1982 and appear to have increased according to the 1983 survey. On the other hand, confidence limits overlap for all years. The numbers of age 4, 5, and 6 were too low in the catches to make any reliable assessment about year-class strength.

Mean length at age was calculated for 1978 and 1983 from age length keys available from the 1978 and 1983 surveys in Div. 3K. Mean weights at age were subsequently calculated by applying the most recent length-weight relationship to the mean length at age (Bowering and Stansbury, 1984). Mean size at age between the 1978 and 1983 surveys were compared and shown in Table 2. The mean size for ages 5 to 7 appears to have declined, however, the more significant ages of 8 and older have increased substantially. Therefore, the decreasing trend in mean numbers per tow from the survey data may not be significant.

## **BIOMASS ESTIMATES FROM SURVEYS**

Estimates of biomass by stratum from fall surveys are presented in Tables 3, 4, and 5 for divisions 2J, 3K, and 3L respectively. Biomass estimates are the sum of estimates for strata that were actually surveyed.

The estimate for Div. 2J (Table 3) for 1983 was 2,751 t down from 3,575 in 1982. The average for the last 3 years was about 2,800 t. In Div. 3K (Table 4), the 1983 estimate was 36,090 t up from 22,220 t in 1982. The average for the last 3 years was about 30,000 t. In Div. 3L (Table 5) the 1983 estimate was 5,638 t down from 7,059 t in 1982. The average of the last three years was about 6,700. The overall average for the last 3 years in all divisions was about 40,000 t.

# MORTALITY ESTIMATES

Since the sampling available was quite limited, the catch at age data from the commercial fishery was considered inadequate for calculating mortality rates. It was considered that the research survey data from Div. 3K might, however, give some long term estimates of mortality. Catch curves were calculated for ages 8-13 from the survey data which is now the major fully recruited portion of the stock (Table 6). Estimates of F varied from year to year (M = 0.20). When all surveys from 1978-83 were combined an F value for ages 8-13 was estimated to be F=0.35 which is near  $F_{0,1}$  for this stock. This average F corresponds to average annual removals of about 8,000-10,000 t.

#### REFERENCES

Bowering, W. R., and D. E. Stansbury. 1984. Regressions of weight on length for witch flounder (<u>Glyptocephalus cynoglossus</u>) of the Eastern Newfoundland area. J. Northw. Atl. Fish. Sci. 5: 105-107.

Month	Country	Gear	NAFO div.	No. meas.	No. aged	Catch (、_t)
January	Can(N)	0T	ЗК	599		169
February	Can(N)	OT	ЗК	772		747
May	Can(N)	OT	3К	948		969
June	Can(N)	OT	ЗК	271		154
June	Can(N)	GN	3L	413		15
July	Can(N)	OT	ЗК	266		128
July	Can(M)	OT	3K	161		130
July	Can(N)	GN	3L	1713		129
August	Can(N)	GN	3L	510		151
September	Can(N)	GN	3K	853		58
September	Can(N)	GN	3L	928		16
October	Can(M)	OT	3L	162		38
November	Can(N)	OT	3K	598		145
03	Can(N)	GN	3L		560	369
Ò1	Can(N)	OT	3K		287	916
02	Can(N)	OT	3K		297	1123
03	Can(N)	OT	3K		88	258
Q4	Can(N)	OT	ЗК		253	183

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Table 1. List of length frequency and age-length key samples available for the Div. 2J3KL witch stock for 1983.

Age	Ĺ(cm) 1978	₩(gm) 1978	No. Fish	Τ(cm) 1983	₩(gm) 1983	No. Fish	₩ <sub>83</sub> - ₩ <sub>78</sub>	% change in mean weight
	31.71	192	48	28.86	138		-54	-28.1
6	35.92	298	52	33.48	233	43	-65	-21.8
7	40.03	435	60	39.01	397	109	-38	-8.7
8	43.02	559	69	43.96	603	165	44	7.9
9	46.88	755	63	47.42	786	172	31	4.1
10	50.04	949	57	51.68	1062	122	113	11.9
11	51.17	1026	44	55.65	1376	82	350	34.1
12	55.80	1389	37	60.83	1878	36	489	35.2
13	59.19	1707	21	62.78	2097	14	390	22.9

Table. 2. Changes in size at age for witch flounder in NAFO Division 3K between 1978 and 1983 from data collected during stratified-random autumn surveys.

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Stratum	Gadus 3 1977	Gadus 15 1978	Gadus 29 1979	Gadus 44 1980	Gadus 58 1981	Gadus 71,72 1982	Gadus 86,87,88 1983
201 202 203	0.0(2) 0.0(2) 0.0(2)	0.0(3) 0.0(2)	0.0(2) 0.0(2)	0.00(3) 0.00(2) 0.00(2)	0.00(5) 0.00(2) 0.00(2)	0.00(6) 0.00(2) 0.83(3)	0.00(6) 0.00(2) 2.42(3)
203	1.59(2)			0.00(2)	2.65(2)	3.17(3)	0.33(3)
205	0.0(4)	0.0(4)	0.0(2)	0.00(4)	0.00(8)	0.04(12)	0.00(8)
206	0.43(11)	0.0(7)	0.0(8)	0.00(7)	0.00(11)	0.13(18)	0.00(14)
207	0.0(5)	0.0(4) 0.61(3)	0.0(5) 0.91(2)	0.00(5)	0.00(9) 2.50(2)	0.13(15) 13.83(3)	1.50(2)
200	0.52(7)	0.0(4)	0.91(2)	0.50(2)	0.00(6)	0.45(11)	0.64(7)
210	1.58(6)	0.34(4)	2.84(2)	4.67(3)	0.25(3)	1.70(6)	0.00(2)
211	12.26(2)	9.53(2)	0.0(2)	0.85(3)	1.75(2)	6.15(2)	0.20(2)
212	26.06(4)	2 50(4)	1 50/4)	0 40(5)	11.25(2)	19.46(5)	22.27(3)
213	1.48(8)	2.50(4)	1.59(4)	0.40(5)	1.50(6)	1.70(10)	0.93(10)
215	1.59(4)	0.03(4) 0.27(5)	0.11(4)	0.00(2)	0.64(5)	0.39(9)	0.00(8)
216	0.0(2)		1.24(2)	1.25(2)	1.25(2)	1.25(2)	2.33(3)
217	0.0(3)				0.00(2)	0.00(2)	0.00(2)
218	0.0(2)				0.00(2)	0.00(2)	0.00(2)
219					0.00(2)		0.00(2)
221							
222	4.82(4)	2.86(3)	1.02(2)	1.25(2)	4.00(2)	6.17(3)	1.33(3)
223	0.68(2)				2.00(2)	0.00(2)	0.00(2)
224	0.0(2)				0.00(2)	0.00(2)	0.00(2)
226	0.0(2)						
227	2.72(4)	•			2.50(2)	5.30(5)	3.25(4)
228	3.43(8)		3.63(4)	4.50(3)	1.08(6)	4.20(10)	1.58(6)
229	2.6/(4)	4.99(2)	4.43(2)	3.00(2)	2.00(2)	2.25(4)	1./6(4)
230	0.0(3)				0.00(2)	0.00(2)	0.00(2)
232	0.0(2)					0100(2)	0000(2)
233	(-)		/ - )				/ - >
234	0.0(2)	0.0(2)	0.0(2)	0.00(2)	0.00(2)	0.00(3)	0.00(2)
235	1/./6(4)				0.85(2)	9.00(3)	22.25(2)
200	0.0(2)				0.00(2)	0.00(2)	0.00(2)
Total							
weight (tons)	3,829	993	1,058	1,109	1,968	3,575	2,751

Table 3. Average weight (kg) per 30-minute set of witch flounder from the autumn surveys of the research vessel <u>Gadus Atlantica</u> in Division 2J (no. of sets in brackets).

Gadus Gadus Gadus Gadus 15 Gadus 29 Gadus 44 58&59 71&72 86,87,88 Stratum 1978 1979 1980 1981 1982 1983 620 4.54(7)3.30(7)2.00(9)0.45(10)0.61(9)0.55(10)621 3.97(7)9.41(8) 1.25(10)1.64(11)0.69(14)3.30(12)14.75(2)622 7.50(3)13.50(2)623 5.94(3)6.57(3)2.88(4)5.41(4)3.40(5)6.75(6)6.51(3)2.15(2)1.75(2)5.25(2)6.00(4)1.75(4)624 625 12.71(3)32.51(3)10.63(4)16.88(4)5.00(2)18.00(3)9.33(3) 11.30(5)39.60(5)36.88(4)626 47.79(4)53.83(3)627 94.75(6)63.00(7)77.25(6) 52.65(2) 23.88(5)26.50(4)10.83(6)22.25(6) 46.83(6)628 629 48.73(3)28.58(2)34.67(3)42.33(3)23.25(2)42.83(3)630 16.55(2)6.03(2)15.75(2) 12.25(2)631 60.90(5)6.00(2)46.30(5)5.77(2) 10.00(2)8.00(3) 9.17(3)632 13.77(3)22.22(2)14.02(6)17.93(7)633 19.28(5)6.32(8)10.96(7)12.49(12)2.72(5) 5.50(5)2.94(7)5.60(11)1.04(5)634 6.16(6)3.52(6)635 20.61(5) 16.87(5)13.50(4)10.80(5)5.50(5)17.25(3)11.25(5)12.20(5) 7.50(6)5.85(10)5.00(6)636 637 18.04(4)28.02(4)16.00(4)17.00(6)17.36(7)35.32(5)17.43(5)26.75(8) 14.62(15)20.82(11) 638 41.12(7)26.42(6)639 14.08(5)10.44(2)15.00(4)11.23(6) 7.55(10) 26.71(7)640 3.25(2)23.00(2)641 1.15(2)1.25(4)4.33(3)0.00(3)642 0.33(6)643 ~ 644 645 0.50(2)16.33(3)13.25(2)0.25(2)646 0.60(2)18.50(2)647 0.00(2)0.00(2)648 649 Total weight (tons) 23,996 31,632 19,517 31,210 22,220 36,090

Table 4. Average weight (kg) per 30-minute set of witch flounder from the autumn surveys of the research vessel <u>Gadus</u> <u>Atlantica</u> in Division 3K (no. of sets in brackets).

Stratum	ATC 323,325 1981	ATC 333,334 1982	W. TEMPLEMAN 7, 8, 9 1983
328	-	_	-
341	0.00(2)	0.20(4)	0.00(4)
342	0.00(3)	0.00(3)	0.00(4)
343	0.00(4)	-	0.00(3)
344	1.75(4)	0.00(3)	0.50(6)
345	19.88(4)	21.87(6)	34.63(8)
346	46.50(3)	18.63(4)	19.50(5)
347	2.83(3)	0.40(4)	0.33(6)
348	0.17(6)	0.60(5)	0.14(11)
349	0.00(7)	0.00(5)	0.00(9)
350	0.00(6)	0.00(2)	0.00(8)
363	0.00(4)	0.50(3)	0.00(3
364	1.06(9)	0.46(11)	0.12(11)
365	0.25(4)	1.25(4)	0.00(5)
366	1.67(3)	3.50(6)	0.00(4)
368	0.50(2)	0.75(2)	-
369	5.75(2)	5.07(4)	1.75(6)
370	0.25(4)	0.00(6)	0.00(6)
371	0.00(4)	0.00(5)	0.00(5)
372	0.00(5)	0.00(7)	0.00(4)
384	-	0.00(4)	1.00(3)
385	0.00(8)	0.00(8)	0.00(5)
386	10.50(3)	1.75(4)	-
387	4.25(2)	13.83(3)	-
388	-	0.87(3)	-
389	-	4.38(4)	-
390	0.00(3)	0.00(4)	0.00(3)
391	-	0.00(2)	0.00(2)
392	-	0.00(2)	1.00(2)
735	-	57.25(2)	-
736	· <b>-</b>	-	23.00(2)
TOTAL	•		
WEIGHT			
(TONS)	7,461	7,059	5,638

Table 5. Average weight (kg) per 30-minute set of witch flounder from fall surveys of the research vessel <u>A.T. Cameron</u> and <u>Wilfred Templeman</u> in Division 3L (no. of sets in brackets)

Age	1978	1979	1980	1981	1982	1983	Total
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	48 172 2,280 2,345 4,705 6,465 4,475 3,454 2,570 1,949 1,001 369 175 40	171 1,891 4,684 10,595 9,162 4,308 3,577 1,713 644 175	214 127 160 687 4,346 4,876 4,876 4,421 4,010 1,789 1,212 830 138 25	105 172 429 4,051 5,581 3,326 2,246 1,062 575 71 14	120 355 555 3,711 5,372 4,002 1,754 1,030 113 16	27 14 25 260 486 2,411 5,898 6,556 4,799 2,661 769 267	27 276 720 5,118 9,186 29,819 37,354 27,088 19,840 10,825 5,262 2,360 521 200 40
8-13 Intercept	11.58	15.33	11.81	15.36	18.56	14.43	15.17
Slope r	-0.35 0.99	-0.75 0.97	-0.39 0.97	-0.80 0.95	-1.15 0.95	-0.64 0.93	-0.55 -0.98
F	0.15	0.55	0.29	0.60	0.95	0.44	0.35

Table 6. Abundance estimates of witch flounder in Division 3K from autumn surveys. Only strata surveyed in all years are included.



Fig.1: Nominal catches of witch in Divisions 2J+3KL (1983 Provisional)



Figure 2. Commercial catch at age of witch flounder in NAFO Divisions 2J3KL from 1976 to 1983 (sexes combined).



Fig. 3. Age composition of witch flounder from research vessel surveys in NAFO Division 3K from 1978-83. Only data from strata common to all years are presented.



Fig. 4. Number per standard tow from selected strata in Div. 3k

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